

3004

B.Tech. (Civil Engg.) 2nd Semester (G Scheme)

Examination, July-2022

MECHANICS

Paper-BSC-Phy-104-G

Time allowed : 3 hours]

[Maximum marks : 75

*Note : Attempt five questions in all, selecting at least one question from each unit. Question No. 1 is compulsory.*

1. (a) Find  $A \times B$ , if  $A = 2i + j + 3k$ ,  $B = 3i + 5j + 2k$ ; (where  $i, j$  and  $k$  are unit vectors along  $x, y$  and  $z$ -axis, respectively).
  - (b) Discuss the various types of forces in nature.
  - (c) What do you mean by equipotential surface?
  - (d) Define and relate angular velocity, momentum and moment of inertia.
  - (e) What is Resultant Force? What would be the angle between two forces when the resultant is maximum and minimum respectively?  $5 \times 3 = 15$

Unit-I

2. What do you mean by constraints notion, explain it with suitable examples? Write the equation of motion for a bead of mass  $m$  moving on a circular wire of radius  $R$ . 15

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3. (a) What are the scalar and vector? Also, discuss the effect of rotation transformation on them. 10  
 (b) What do you mean by a frictional force, and how does it relate to the angle of response? 5

**Unit-II**

4. What are central and non-central forces? Derive the energy equation and energy diagrams for elliptical, parabolic and hyperbolic orbits. 15  
 5. What do you understand by damped harmonic oscillations? Explain the terms lightly damped, overdamped and critically damped oscillations using its differential equation of motion. 15

**Unit-III**

6. (a) State and prove the perpendicular axis theorem for a moment of inertia for a plane lamina. 10  
 (b) A flywheel has moment of inertia  $70 \text{ kg m}^2$  and its axle has diameter  $4.4 \text{ cm}$ . How much pull should be applied on a thread wound on the axle to produce an angular acceleration of  $0.5 \text{ rad/s}^2$ ? 5  
 7. (a) Discuss the relation angular momentum and angular velocity and define a moment of inertia tensor. 10

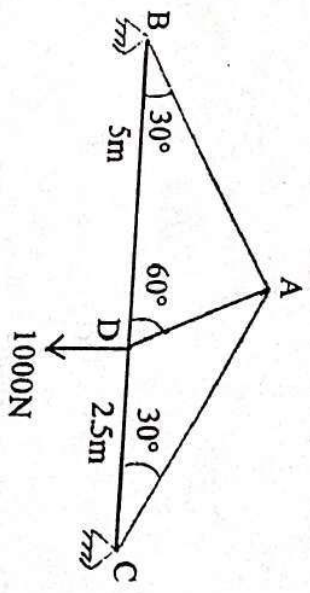
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- (b) Calculate the moment of inertia of a solid sphere about one of its diameters. 5

**Unit-IV**

8. (a) Define trusses and explain perfect and non-perfect trusses. What are the main assumptions in truss analysis? 8  
 (b) What are the conditions of equilibrium in three and two dimensions? 7  
 9. Analyse the given truss of  $BC = (BD + DC) = 5\text{m} + 2.5\text{m}$  spans, loaded at D shown in the figure. Find the magnitude and nature of the force in all members. 15



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